

# THE PHYSIOGRAPHY OF THE SHOALHAVEN RIVER VALLEY. III.

## BULEE RIDGE.

By FRANK A. CRAFT, B.Sc., Linnean Macleay Fellow of the Society in Geography.

(One Text-figure.)

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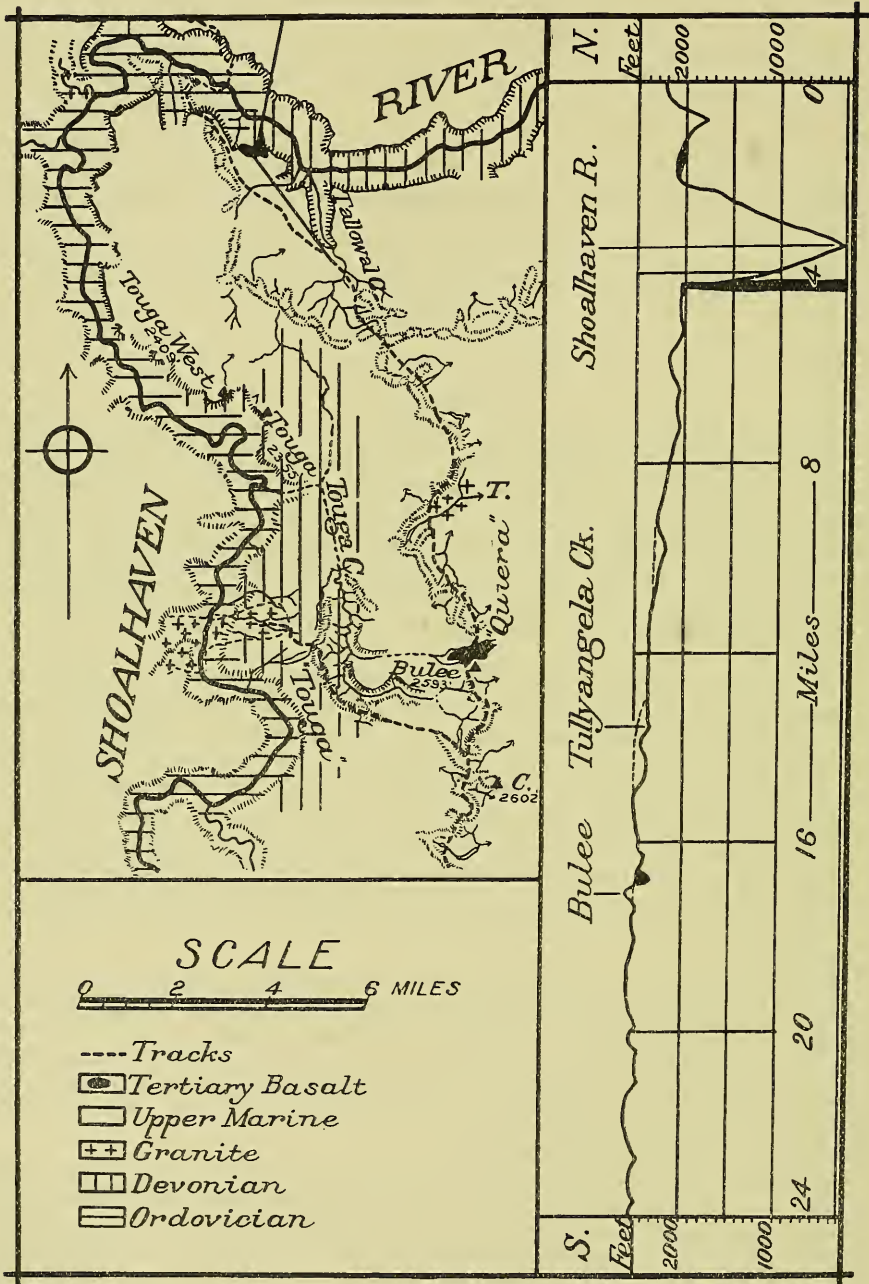
### *Introduction.*

This short paper is the result of a reconnaissance carried out during January, 1931, on the Bulee Ridge, named after a high trigonometrical point in its central portion. On account of its rocky and sandy nature, and the generally dissected character of its surface, this part of the eastern watershed of the Shoalhaven Valley has only been surveyed in places, and much is only accessible on foot by roundabout routes. The traverses on which this account is based were practically confined to the high ridges, and were undertaken to give some definition of the place where the tableland over which the Shoalhaven flows begins to fall towards the coast.

The surface covering of this portion of the tableland consists of sandstones belonging to the Upper Marine Series. These rise from sea-level on the coast to a maximum altitude of 2,600 feet on the ridge here described. Towards the west they thin quickly, and their western periphery has been cut off sharply by the erosion which has produced the Shoalhaven Plain at 2,000 feet. The series consists of whitish agglomerate and conglomerate of a sandy nature containing pieces of various quartzes, quartzites and porphyritic rocks which pass upwards into a white, reddish or light-grey sandstone of a gritty nature. The sandstones contain occasional layers of quartz pebbles and are marked by a massive character with widely-spaced and irregularly-developed joints, of which two sets exist almost at right angles.

The thickness of the series varies from 150 to 400 feet, although in the neighbourhood of Tallowal Creek a thickening to 600 feet is noticed. The altitude of the base varies from 1,900 to 2,250 along the exposed western margin, the former limit being near the head of Touga Creek whilst the latter is at Touga Trig. station. Irregularities in bedding are also noticed, in some cases the bedding planes dipping locally at angles up to eight degrees. These places are exposed by denudation and form bare convex slopes.

Underlying the sandstones are strata of supposedly Devonian age and, along the course of the river, an intensely folded metamorphic series of Ordovician age is found. The former consists of reddish and brown sandstones, shales and slates, but there is apparently no clear differentiation from the older strata, which grade upwards into almost unaltered sedimentary rocks. Nor can a great deal be told off-hand from the degree of folding of the various strata, for intense folding, crumpling and shearing are found mainly within a definite meridional core of the older rocks at the lower levels.



Text-fig. 1.—Sketch-map and Profile of Bulee Ridge. The area covered by the Upper Marine Series comprises the level tableland. The profile line is taken along the road, with minor bends smoothed out. The line north-west and north from Tallowal Creek is the northern section, and the southern end extends 4,700 yards SSE. of the road end on the map to the Nowra-Nerriga road. Vertical exaggeration of profile = 10.6. C = Coolumburra, and T = Tullyangela. The magnetic meridian is used.

Igneous rocks are represented by isolated occurrences of granite, by basalt dykes in the gorge of the river, and by isolated patches of late Tertiary basalt on the tableland. The most notable of these latter is found above the Shoalhaven River near Talloval Creek, where the precipices are broken by a neck from which lava has been poured on to the adjacent level surface. A beautiful section is now exposed on top of the precipice, and in a nearby small gully the horizontal sandstones have been hardened to a glassy quartzite to a depth of 6 feet.

The topographic significance of these formations is readily appreciated. The hard quartzites and quartz-schists of the oldest rocks are not found on the tableland surface, and they have been cut through by the powerful Shoalhaven River. Where the stream crosses their strike it passes through narrow clefts in immense bars, so it has a turbulent nature in a steep-sided gorge. The massive horizontal sandstones of the tableland surface resist erosion more strongly than the softer and more broken older rocks immediately underlying them, so the gorges and gullies cut through them are crowned by lines of perpendicular cliffs. Weathering of softer bands in the sandstones gives rise to terraces bounded by low precipices, so the surface of Bulee Ridge forms a long, terraced platform.

#### *Topography and Physiography.*

Passing northward along the ridge (Text-fig. 1), a sandstone ridge is traversed which varies from 2,400 to 2,550 feet in altitude. It forms the divide between the Shoalhaven River and Ettrema Creek, and in places tributary gullies have been extended right to the ridge by falling streams, giving a series of saddles or cols between which the ridge is higher and more level. Level branches of the main ridge extend from two to three miles east and west, the former ending in the precipices above Ettrema Creek, whilst those in the latter direction terminate in the low escarpment of the Upper Marine Series overlooking the Shoalhaven Plain. Between this escarpment and the gorge sides of the Shoalhaven there is an irregular terrace varying in altitude from 2,000 to 2,300 feet forming, in fact, the eastern edge of the Shoalhaven Plain. In the granite and older sandstone at "Touga" station, these undulations have a width of a mile and a half, and rise from 1,800 feet on the edge of the gorge to 2,000 feet on the east, where there is a sharp rise over 2,300 feet to the ridge west of Touga Creek which is capped with horizontal sandstone, or from which the newer rock has been recently denuded.

Two points rise a little above the general level of the ridge—Coolumburra (2,602 feet) and Bulee (2,593 feet) Trig. stations. Immediately to the north of the latter the ridge consists of a basalt plain at 2,440 feet. The basalt occupies a narrow valley whose floor is 300 feet below the trig. station, and has been attacked with vigour on the west by a stream which falls quickly into a rough gully, and eventually unites with Touga Creek. Gentler valleys lead eastward, but they also give place to walled-in gullies. In other places to the east of the ridge streams head in boggy flats on the sandstone terraces, across which they fall gently for the first part of their courses.

Proceeding north of the Quiera basalt, a rough ridge leads to the head of Tullyangela Creek. The crest is at 2,500 feet, but terraces fall on the eastern side from 2,350 feet. The first part of Tullyangela Creek is in a gentle granite valley at 2,300 feet almost surrounded by low sandstone cliffs. On the opposite side of the ridge the gully heads are also gentler than usual, but the rough gorges are soon reached in either direction.

Up to this point bare rock terraces of slightly uneven sandstone form part of the ridge top. These also continue a little to the north of Tullyangela Creek, but the ridge falls to 2,300 feet, and level depressions lead over its surface and, being filled with a thin deposit of peaty soil, the hitherto bare rock terraces give place to areas of heath and coarse meadow. Rain falling in such places either runs off gently or is absorbed by the spongy soil to be given up eventually by evaporation. Thus the forces of erosion on this section of the ridge crest are very slight indeed.

Gentle valleys are here excavated to a depth of 150 feet below the ridge crest. The most notable fall to Ettrema Creek, here five miles distant, whilst the western fall to the main gully is only two miles long. The Bulee Ridge properly ends where the northward fall to the Shoalhaven gorge begins, and where very gentle sandy slopes lead to the edges of the precipices. These vary in altitude from 2,000 to 2,100 feet, and the southward rise is gently concave. Small swamps are found on the slope, which is covered with a thick mantle of sand, although level areas are grassy. Otherwise the vegetation is a sparse forest or scrub. Immediately above the cliffs the streams flow through short gullies 50 feet deep, and the cliffs have receded along their courses to form bays in the main gorge side.

Passing from Tallowal Creek towards Touga West Trig. station, a gentle plain between 2,150 and 2,200 feet is crossed whose surface is largely covered with acacia scrub. Where the horizontal sandstones exist, the fall to the gullies is marked by low cliffs, but the gullies are mainly cut in older rocks and are extremely wild and steep-sided. The principal fall is to Touga Creek through unsurveyed country, the river eventually being met about 650 feet above sea-level. The area occupied by Touga and Touga West Trig. stations forms a high bluff falling directly to the river. Only to the south do the lower terraces exist on the eastern side of the gorge.

Mention has been made of the basalt neck near Tallowal Creek. Although the modern extent of the flows in its vicinity is not considerable, a great deal must have been swept away in the erosion of the gorge, and there may have been a considerable extent of basalt in the pre-gorge valley of the Shoalhaven.

#### *Soil and Water Supply.*

Many of the salient points of the soil and water supply relationships of the ridge will have been deduced already. The horizontal sandstones are almost impervious, so the ridge itself, with only a thin mantle of sandy soil, is dry and barren. In the areas of older rocks there is a great deal of steep and rugged topography, so the sandy and light soils formed from their weathering are easily washed away, leaving crumbling and rocky slopes exposed which are held together by scrub and sparse forest. Thus the siliceous rocks of the area give rise to sandy soils—thin both in the uplands and on the gorge sides. In the former instance, the strong westerly winds of winter sweep the ridge crest, and allow a rather thicker screening of soil on the eastern slopes, but the natural deficiency in plant foods is reflected in a poor vegetation.

Exceptions to the general rule comprise the small areas of basalt and granite, and the sandstone part of the levels at "Touga" station. In the latter case there is an accumulation of soil on the older topographic features, a condition which also prevails on the level stretches near Tallowal Creek. These are the only parts of the area which are of much use: they support a few sheep.

As regards water supply, mention has been made of the swamps due to accumulation of water in the soil and humus resting in hollows on the sandstone terraces. Streams rising from these limited sources are not permanent, although to the south and south-east where larger swamp areas are found they provide water all the year round. Springs occur at the base of the basalts and there are streams in the granitic areas of "Touga" station and Tullyangela Creek, but the general dryness of the country can be gathered from the fact of Touga and Tallowal Creeks ceasing to flow during the warmer months. Topography, soil and water supply all militate against settlement in the area, and people only live permanently on "Talwong" station, by Tallowal Creek.

*Summary.*

The Bulee Ridge forms a level tableland in horizontal sandstones and extends to the beginning of the coastal fall in the vicinity of the meridional Etrema Creek. The coastal fall has an average angular value of one degree. The ridge rises gently from north to south and forms a straight, stable divide for the eastern section of the corresponding portion of the Shoalhaven Valley. Streams on the coastal slopes to the east also fall to the Shoalhaven River, but are clear of the tableland proper.

The basalt of Quiera indicates late Tertiary erosion on the ridge down to 2,300 feet above sea-level, whilst similar but higher cols along the ridge make similar processes extend to the present day. It is probable that the basalt does not occur on the original ridge crest, but a little to the east or west of it, as it appears to occupy a very level valley. The higher country corresponds with the extent of the horizontal sandstones, which have exercised a definite protective influence whilst the Shoalhaven Plain has been eroded in older strata immediately to the west. The nearest comparable heights to those on Bulee Ridge are found at the head of Windellama Creek, on the western side of the Shoalhaven Valley, the whole country between having suffered extensive denudation.

The eastward turn of the Shoalhaven River is clear of the higher part of the ridge, and a wide upland depression about 2,000 feet above sea-level has been trenched by the modern gorge. Physiographically the ridge is notable as forming a stable divide on the eastern side of the meridional course of the Shoalhaven, and protecting the Shoalhaven Valley from the destructive erosional influences of the coastal slope.

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